

## The Impact of Agroforestry-Based Soil Fertility Replenishment Practices on the Poor in Western Kenya

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**T**his study examines the impact of tree-based improved fallow and biomass transfer systems on the rural poor in western Kenya. Western Kenya is one of the most densely populated areas in Africa but is considered to have good potential for agriculture. The history of farming in the area, however, is characterized by low input-low output farming. Crop productivity is very low and nutrient balances are seriously in deficit. As a result, along with swelling population and decreasing farm sizes, poverty is rampant in the region.

The study examines the impact of an agroforestry research program that had as one of its pillars systems to improve welfare through soil fertility replenishment (SFR). Two that appeared most promising were improved fallows and biomass transfer. "Improved fallow" refers to the intentional planting of a fallow species. Improved fallows are more efficient than natural fallows and can normally achieve the same effect on crop productivity in a much shorter time. Biomass transfer systems are those where organic nutrient sources are grown in one place and then transferred to crops in another place. This system allows farmers to grow crops continuously, which is an advantage over the improved fallow system, but the available space for producing organic nutrient sources on-farm is limited.

### *Purpose of This Study*

This study is one of a set of IFPRI-managed case studies examining the impact of agricultural research on poverty. This technology was selected for this study because it is an example of natural resource management research as opposed to the more common crop variety research. Because the agroforestry technologies offered an affordable option for soil fertility improvement, it was expected that rates of use and adoption would be relatively high among the poor. Further, there was some question whether the nonpoor would perceive any benefits of agroforestry compared to fertilizer. Even if there were such a perception, it is still an empirical issue as to whether the poor actually can substantially benefit from the use of agroforestry technologies. This would seem to depend on their understanding of how to effectively manage the systems as well as their capacity and willingness to increase their land and labor investment in these systems.

### *Methodology*

The range of issues covered in the study required the use of a mix of research methods and interdisciplinary perspectives. Issues pertaining to local perceptions of poverty, the

mediation of technology by social processes, and the role of gender, power, and other social constructs in understanding adoption and impact could only be explored using qualitative research methods and sociological perspectives. These were combined with quantitative measures of adoption and impact and economic analysis. The quantitative analyses proved valuable in identifying how common patterns of adoption and impact relationships were among the general population and the poor. We also drew on long-term knowledge of the region, based on work by members of our study team and others.

### *Highlights of Empirical Findings*

While there is no doubt that poverty is pervasive in western Kenya, distinguishing the poor from nonpoor is not straightforward. The study used a variety of methods to assess poverty levels, including quantitative measures from surveys, enumerator ratings, and farmer self-assessments. These produce different outcomes so that which households will be classified as very poor will depend on the criteria used.

Welfare or livelihood outcomes worsened for many households. There was a general deterioration in welfare indicators during the period of study. This holds true for assets, expenditures, and food consumption. Particularly striking was that households with relatively high welfare indicators in the initial period suffered the greatest losses. This is due partly to the large number of adverse shocks affecting households and the cultural obligations felt by all community members.

SFR technology interventions imply assumptions about the role of agriculture in people's livelihoods that have varying validity. The role of agriculture in people's livelihoods is determined by economic circumstances, culture, normative frameworks, and social identities. The assumption that poverty can be reduced through farming is not necessarily reflected in the investments in livelihood activities made by people in the region. Their decisions are em-

bedded in their economic circumstances, cultural, normative frameworks, and social identities.

Households do see the importance of SFR—and there have been many human capital impacts. Both the qualitative and quantitative research found significant knowledge acquisition taking place, not only for agroforestry methods, but for general soil management and farming practices. People valued this information and have often put it into practice.

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The poor are adopting SFR strategies at the same rates as the nonpoor. Adoption rates are not outstanding but are encouraging, with about 20 percent of all farmers using the technologies on a regular basis (a similar percentage among the poor) and a sizable percentage of farmers newly testing. This suggests that unlike some agricultural technologies historically, SFR is not biased toward people controlling and managing resources above a certain threshold.

Adoption at the early stage is at low levels of intensity. While an encouraging number of households are using or testing the SFR practices, the size of plots on which they are applied remain small. It is not yet known whether this is indeed a ceiling or whether this is a consequence of the early stage of dissemination.

The dissemination analysis found that farmers appreciated some aspects of different disseminating organizations and the many different methods tried. Social status and social relationships within villages affect outcomes of different dissemination methods. New technologies can also reinforce or transform these relationships. Although characteristics of SFR affect whether people adopt or not, aspects of the dissemination process also affects adoption. The dissemination analysis found that the main feature of most dissemination approaches—group-based methods—can strengthen human and social capital, and farmers of different social status have benefited from them. However, this analysis also found that group-based approaches may also disadvantage farmers of lower social status and women who are less likely to participate in or dominate groups. These findings reinforce the conclusion that use of a variety of methods are best.

Sustainability of dissemination structures and processes has proved to be possible, but challenging, because of problems encountered by groups, limited capacity of local administration, social dynamics within villages, and limited cost-sharing ability. Monitoring would help to pick up these problems so that resolutions can be sought where possible.

SFR does significantly raise crop yields. Respondents in the case studies and formal surveys consistently report very significant increases in yields from the use of SFR practices.

This is consistent with farmer-managed trial data that find similar increases.

Despite the fact that SFR is being used by a number of poor households and having an impact on yields, its impact at the household level is modest. This is due to the small land sizes under SFR and because the weak rural economy is not conducive for investment and development. This means that technological innovations alone are likely to have a limited short-term impact. Poverty alleviation should encompass other sectors as well.

### **Discussion**

Pathways out of poverty are varied and highly uncertain. Identifying clear strategies through agriculture is equally difficult due to low prices, variable climate, and high costs of profitable investments. Small land sizes, in turn, limit the amount of diversification that households are willing to undertake. It seems that for widespread poverty alleviation to take place, many components of the rural socioeconomy need to be functioning well. Even if progress is made, the study has clearly shown that households can easily slip back into poverty. Therefore, in addition to generating production and income, there is need for insurance through investment in risk-buffering assets.

The soil fertility systems being disseminated are useful options for farmers, and these options are being tried by many with no prior record of investment in soils. There are clear limitations to the use of improved fallows and biomass transfer, however. Small farm sizes limit the extent to which niches can be found to produce the green manures. The technologies are therefore best perceived as feasible and viable components of farm-level integrated soil fertility management strategies. Consequently, dissemination strategies should encompass a range of management practices for addressing the problem of poor soil fertility.

**Keywords:** poverty, agricultural research, sustainable livelihoods, vulnerability, agricultural extension, Kenya

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